

EXHIBIT 21

(Excerpted)



US010439896B2

(12) **United States Patent**
Millington et al.

(10) **Patent No.:** **US 10,439,896 B2**

(45) **Date of Patent:** ***Oct. 8, 2019**

(54) **PLAYBACK DEVICE CONNECTION**

(56) **References Cited**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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This patent is subject to a terminal disclaimer.

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(21) Appl. No.: **16/298,542**

(22) Filed: **Mar. 11, 2019**

(65) **Prior Publication Data**

US 2019/0207825 A1 Jul. 4, 2019

Related U.S. Application Data

(63) Continuation of application No. 15/091,113, filed on Apr. 5, 2016, which is a continuation of application (Continued)

(51) **Int. Cl.**

H04L 12/24 (2006.01)

H04L 29/06 (2006.01)

(Continued)

(52) **U.S. Cl.**

CPC **H04L 41/22** (2013.01); **G06F 3/0481** (2013.01); **G06F 3/0482** (2013.01); (Continued)

(58) **Field of Classification Search**

CPC H04L 41/22; H04L 12/28; H04L 41/0809; H04L 63/10; H04L 65/60; H04L 67/02; (Continued)

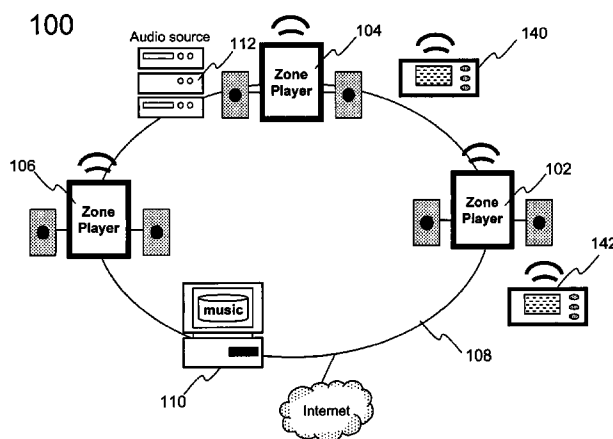
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ABSTRACT

An example computing device includes programming to perform functions including, while operating on a secure WLAN, (a) receiving user input indicating that a user wishes to set up a playback device to operate on the secure WLAN and (b) receiving a first message indicating that a given playback device is available for setup, then transmitting a response to the first message that facilitates establishing an initial communication path with the given playback device outside of the secure WLAN. The functions also include transmitting, to the given playback device via the initial communication path, a second message containing network configuration parameters including an identifier of, and a security key for, the secure WLAN, then detecting an indication that the given playback device has successfully received the network configuration parameters. The functions also include transitioning from communicating with the given playback device via the initial communication path to communicating with the given playback device via the secure WLAN.

20 Claims, 9 Drawing Sheets



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Related U.S. Application Data

- No. 14/486,667, filed on Sep. 15, 2014, now Pat. No. 9,866,447, which is a continuation of application No. 13/618,829, filed on Sep. 14, 2012, now Pat. No. 8,868,698, which is a continuation of application No. 11/147,116, filed on Jun. 6, 2005, now Pat. No. 8,326,951.
- (60) Provisional application No. 60/577,284, filed on Jun. 5, 2004.
- (51) **Int. Cl.**
G06F 3/0484 (2013.01)
G06F 3/0482 (2013.01)
H04L 29/08 (2006.01)
H04W 12/04 (2009.01)
H04W 12/08 (2009.01)
H04L 12/28 (2006.01)
G06F 3/0481 (2013.01)
H04W 12/00 (2009.01)
H04W 84/12 (2009.01)
- (52) **U.S. Cl.**
CPC **G06F 3/04842** (2013.01); **G06F 3/04847** (2013.01); **H04L 12/28** (2013.01); **H04L 12/2803** (2013.01); **H04L 12/2807** (2013.01); **H04L 12/2809** (2013.01); **H04L 41/0809** (2013.01); **H04L 63/10** (2013.01); **H04L 65/60** (2013.01); **H04L 67/02** (2013.01); **H04L 67/10** (2013.01); **H04L 67/141** (2013.01); **H04W 12/003** (2019.01); **H04W 12/04** (2013.01); **H04W 12/08** (2013.01); **H04L 41/28** (2013.01); **H04L 63/065** (2013.01); **H04L 63/0823** (2013.01); **H04L 2012/2841** (2013.01); **H04L 2012/2849** (2013.01); **H04W 84/12** (2013.01)
- (58) **Field of Classification Search**
CPC H04L 67/10; H04L 67/141; G06F 3/04; H04W 12/04; H04W 12/08
USPC 709/222
See application file for complete search history.
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According to one aspect of the present invention, a wired and/or wireless Ad-hoc network is established to facilitate communications among a group of devices. According to one aspect of the present invention, when a new device is added to the network, a rudimentary communication path is initially established between one of the devices (“first device”) in the network and the new device (“second device”) such that necessary parameters (e.g., SSID, WEP security, channel frequency) can be exchanged for the new device to function properly in the network. To ensure the parameters are exchanged in a secure fashion, an additional public security procedure can be used between the two devices.

The detailed description of the present invention is presented largely in terms of procedures, steps, logic blocks, processing, or other symbolic representations that directly or indirectly resemble the operations of devices or systems that can be used on networks. These descriptions and representations are typically used by those skilled in the art to most effectively convey the substance of their work to others skilled in the art.

Reference herein to “one embodiment” or “an embodiment” means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one embodiment of the invention. The appearances of the phrase “in one embodiment” in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Further, the order of blocks in process flowcharts or diagrams or the use of sequence numbers representing one or more embodiments of the invention do not inherently indicate any particular order nor imply any limitations in the invention.

Embodiments of the invention are discussed herein with reference to an audio system with multi-zone capability. However, those skilled in the art will readily appreciate that the detailed description given herein with respect to the audio system is for explanatory purposes as the invention extends beyond these limited embodiments.

Referring now to the drawings, in which like numerals refer to like parts throughout the several views, FIG. 1 shows an exemplary configuration 100 in which the present invention may be practiced. The configuration may represent, but not be limited to, a part of a residential home, a business building or a living complex with multiple zones. There are a number of multimedia players of which three examples 102, 104 and 106 are shown as audio devices. **Each of the audio devices may be installed or provided in one particular area or zone and hence referred to as a zone player herein.**

As used herein, unless explicitly stated otherwise, a track and an audio source are used interchangeably, an audio source or audio sources are in digital format and can be transported or streamed across a data network. To facilitate the understanding of the present invention, it is assumed that the configuration 100 represents a home. Thus, the zone player 102 and 104 may be located in two of the bedrooms respectively while the zone player 106 may be installed in a living room. All of the zone players 102, 104 and 106 are coupled directly or indirectly to a data network 108. In addition, a computing device 110 is shown to be coupled on the network 108. In reality, any other devices such as a home gateway device, a storage device, or an MP3 player may be coupled to the network 108 as well.

The network 108 may be a wired network, a wireless network or a combination of both. In one example, all devices including the zone players 102, 104 and 106 are

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coupled to the network 108 by wireless means based on an industry standard such as IEEE 802.11. In yet another example, all devices including the zone players 102, 104 and 106 are part of a local area network that communicates with a wide area network (e.g., the Internet).

All devices on the network 108 may be configured to download and store audio sources or receive streaming audio sources. For example, the computing device 110 can download audio sources from the Internet and store the downloaded sources locally for sharing with other devices on the Internet or the network 108. The zone player 106 can be configured to receive streaming audio source and share the source with other devices. Shown as a stereo system, the device 112 is configured to receive an analog source (e.g., from broadcasting) or retrieve a digital source (e.g., from a compact disk). The analog sources can be converted to digital sources. In accordance with the present invention, all audio sources, regardless of where they are located or how they are received, may be shared among the devices on the network 108.

Any device on the network 108 may be configured to control operations of the zone players 102, 104 and 106. In particular, one or more controlling devices 140 and 142 are used to control zone players 102, 104 and 106 as shown in FIG. 1. The controlling devices 140 and 142 are preferably portable and remotely control the zone players via wireless means (e.g., infrared, radio, wireless standard IEEE 802.11b or 802.11g). In one embodiment, besides controlling an individual zone player, the controlling device 140 or 142 is configured to manage audio sources and other characteristics of all the zone players regardless where the controlling device 140 or 142 is located in a house or a confined living complex.

Referring now to FIG. 2A, there is shown an exemplary functional block diagram of a zone player 200 in accordance with the present invention. The zone player 200 includes a network interface 202, a processor 204, a memory 206, an audio processing circuit 210, a digital signal processing module 212, and an audio amplifier 214. The network interface 202 facilitates a data flow between a data network (i.e., the data network 108 of FIG. 1) and the zone player 200 and typically executes a special set of rules (i.e., a protocol) to send data back and forth. One of the common protocols is TCP/IP (Transmission Control Protocol/Internet Protocol) commonly used in the Internet. In general, a network interface manages the conversion of an audio source or file into smaller packets that are transmitted over the data network or reassembles received packets into the original source or file. In addition, the network interface 202 handles the address part of each packet so that it gets to the right destination or intercepts packets destined for the zone player 200.

The network interface 202 may include either one or both of a wireless interface 216 and a wired interface 217. The wireless interface 216, also referred to as a RF interface, provides network interface functions by a wireless means for the zone player 200 to communicate with other devices in accordance with a communication protocol (such as the wireless standard IEEE 802.11a, 802.11b or 802.11g). The wired interface 217 provides network interface functions by a wired means (e.g., an Ethernet cable). Depending on implementation, each of the zone players may be equipped with either one or both of the interfaces 216 or 217. In one embodiment, a zone player, referred to as an access zone player, including both of the interfaces 216 and 217 is coupled to an access point of an LAN and communicates with other zone players wirelessly. Thus these other zone